



Pulse Sowing Machine Using IoT

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Publication History: Received: 25.02.2026; Revised: 20.03.2026; Accepted: 25.03.2026; Published: 28.03.2026.

ABSTRACT: Agriculture is the backbone of many countries, and modern technology helps farmers improve productivity. The IoT based gram sowing machine is designed to make the sowing process easier and more efficient. This system uses sensors and internet technology to monitor and control the sowing operation. The machine helps in placing gram seeds at proper distance and depth in the soil. It reduces manual work and saves time for farmers. The system can also provide information about soil condition and machine status. This project improves accuracy in farming and supports smart agriculture.

KEYWORDS: IoT, Smart Agriculture, Gram Sowing Machine, Automation, Sensors

I. INTRODUCTION

Agriculture is one of the most important sectors that supports the economy and provides food for the growing population. Farmers depend on efficient farming techniques to increase crop productivity and reduce labour. Traditional methods of seed sowing require a large amount of manual work and time. In many rural areas, farmers still use manual sowing techniques which may lead to uneven seed distribution, improper spacing between seeds, and wastage of seeds. These problems can affect plant growth and reduce overall crop yield.

To overcome these challenges, modern technology is being introduced in agriculture. The Internet of Things (IoT) plays an important role in developing smart agricultural systems. IoT allows devices to connect and communicate with each other through the internet,

enabling farmers to monitor and control farming activities efficiently. By integrating IoT with agricultural machinery, farming operations can become more accurate, efficient, and less labor-intensive. The IoT Based Gram Sowing Machine is designed to improve the process of sowing gram seeds in agricultural fields. This machine helps in placing seeds at proper depth and equal spacing in the soil, which is essential for healthy crop growth.

The system uses electronic components such as sensors, microcontrollers, and motors to automate the sowing process. Sensors can collect information about soil conditions, while the microcontroller controls the operation of the machine. Another advantage of using IoT technology in this system is the ability to monitor the machine remotely. Farmers can receive information about the sowing process, soil moisture levels, and machine performance through connected devices. This helps farmers make better decisions and manage their crops more effectively.



The main objective of this project is to develop a smart sowing machine that reduces manual effort, saves time, and increases the efficiency of seed planting. By using IoT technology, the system supports precision agriculture and contributes to improving agricultural productivity. This project aims to provide a simple and cost-effective solution that can be easily used by farmers to enhance farming practices and promote modern agriculture.

II. MATERIALS REQUIRED

1. Microcontroller (ESP32-CAM / Node MCU)

The microcontroller acts as the main control unit of the system. It controls all the components used in the gram sowing machine. The microcontroller receives input data from the soil moisture sensor and processes the information to operate other components such as the DC motor.

ESP32-CAM or Node MCU are commonly used because they support Wi-Fi connectivity, which is required for IoT applications. ESP32-CAM also has a built-in camera that can be used to monitor the field visually. The microcontroller sends data to the internet so farmers can monitor the sowing process remotely through a mobile phone or computer.

2. Soil Moisture Sensor

The soil moisture sensor is used to measure the moisture content present in the soil. It help to determine whether the soil condition is suitable for seed sowing. The sensor sends the soil moisture data to the microcontroller, which can analyze the information and make decisions based on the soil condition. This helps farmers understand the soil status and ensures better crop growth.

3. Seed Container

The seed container is used to store the gram seeds before the sowing process. It is usually placed at the top part of the machine. The container is connected to a small opening or pipe through which seeds are released into the soil. The design of the container allows seeds to flow smoothly and prevents blockage. It ensures that seeds are supplied continuously during the sowing process.

4. DC Motor

The DC motor is used to provide mechanical movement in the sowing machine. It helps rotate the seed dispensing mechanism so that seeds are released into the soil at regular intervals. The motor is controlled by the microcontroller, which decides when the motor should start or stop. This helps maintain proper spacing between seeds.



5. Wheels and Frame

The frame forms the structure of the machine and supports all the components such as the seed container, motor, sensors, and controller. The wheels help the machine move across the agricultural field. As the machine moves forward, seeds are automatically dropped into the soil. The frame must be strong and stable so that the machine can work efficiently in different field conditions.

6. IoT Module (Wi-Fi)

The IoT module enables the machine to connect to the internet. It allows farmers to monitor the sowing process and soil conditions remotely using a mobile phone or computer. Through the Wi-Fi module, data collected by sensors can be sent to a cloud platform or mobile application. This improves monitoring and makes farming smarter and more efficient.

7. Power Supply (Battery)

The system is powered using a **rechargeable battery** which provides the required electrical energy to all the components of the machine. The battery supplies power to the **microcontroller, sensors, motor driver, and motor** used in the gram sowing machine. A **12V rechargeable battery** is commonly used because it provides stable voltage and can run the motor efficiently. The battery capacity is measured in **Ampere-hour (Ah)**, which indicates how long the battery can supply power.

The battery provides the electrical power required to operate the entire system. It supplies power to the microcontroller, sensors, motor, and IoT module. A rechargeable battery is usually preferred so that the machine can be used in fields without direct electricity supply. Proper power management ensures that the machine runs smoothly during the sowing operation.



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III. METHODOLOGY

1. Power Supply Using Battery

The entire system of the gram sowing machine is powered by a rechargeable battery. The battery provides electrical energy to operate all the electronic components such as the microcontroller, sensors, DC motor, and IoT module. When the battery is switched on, the power is distributed to all components, and the system begins its operation. Using a battery makes the machine suitable for agricultural fields where direct electricity supply may not be available.

2. Seed Storage in Seed Container

The gram seeds are stored in a seed container that is fixed on the top part of the machine. The container is designed to hold enough seeds during the sowing process. At the bottom of the container, a small opening is provided through which the seeds are released. This container ensures that seeds are supplied continuously and prevents seed wastage while sowing.

3. Motor Operation for Seed Release

A DC motor is used to operate the seed dispensing mechanism. When the motor rotates, it helps in releasing seeds from the container into the soil. The motor rotates at regular intervals so that seeds are dropped at equal distances. This controlled seed release improves proper spacing between plants and helps in better crop growth.

3. Soil Condition Monitoring Using Sensors

A soil moisture sensor is used to check the moisture level of the soil before sowing. The sensor probes are inserted into the soil to detect the amount of water present in it. The sensor collects this data and sends it to the microcontroller. This helps determine whether the soil is suitable for sowing seeds.

4. Microcontroller Control of the System

The microcontroller acts as the central control unit of the machine. It receives the soil moisture data from the sensor and processes the information. Based on this data, the microcontroller controls the DC motor and manages the seed sowing process. It ensures that seeds are released only when the soil conditions are appropriate.

5. Data Transmission through IoT Module

The IoT module with Wi-Fi connectivity is used to send information from the system to the user. The data collected from sensors, such as soil moisture levels and system status, is transmitted through the internet. Farmers can monitor this information remotely using a mobile phone or computer. This helps in better decision-making and efficient management of farming activities.

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Application for operate:

Overview

The mobile application is designed to monitor and control the pulse sowing machine remotely using IoT technology. It connects sensors and the microcontroller (ESP32) through Wi-Fi or Bluetooth, allowing farmers to access real-time field data and control operations from anywhere.

Key Features of the App

1. Real-Time Monitoring

- The app displays live data collected from sensors such as:

Soil moisture

Temperature

Humidity

- This helps farmers understand field conditions instantly.

2. Seed Sowing Status

The application shows:

- Machine ON/OFF status
- Seed dispensing activity
- Motor working condition

3. Remote Control

Farmers can control the machine through the app:

- Start / Stop sowing
- Control DC motor
- Activate/deactivate system
- This reduces manual labor and improves efficiency.

4. Alerts & Notifications

The app sends alerts when:

- Soil moisture is too low or high
- Machine stops or faces an issue
- Field conditions are not suitable

5. Automated Operation

The app works with programmed logic:

- If soil moisture is low → sowing starts
- If moisture is high → sowing stops
- This ensures proper seed placement and avoids wastage.

6. Data Storage & Analysis

- Stores previous data (history)
- Shows graphs of soil moisture and machine activity
- Helps improve future farming decisions ♦
- MDPI

7. User-Friendly Dashboard

- Simple interface
- Easy to use for farmers
- Displays all information in one screen

Technologies Used

- ESP32 (Wi-Fi enabled microcontroller)
- Cloud platform (ThingSpeak / Firebase)
- Mobile App (Android / Web App)



SEED SPREYING ROBOT

FORWARD

REVERSE

STOP

RIGHT

LEFT

SEED ON

SEED OFF

Working of the App

- Sensors collect soil data
- Data is sent to ESP32
- ESP32 uploads data to cloud
- Mobile app fetches data from cloud
- User monitors and controls system remotely

Advantages of the App

- Saves time and labor
- Improves accuracy in sowing
- Enables remote farming
- Increases crop productivity
- Reduces water and seed wastage



IV. CONCLUSION

The IoT-based mobile application acts as the brain interface between the farmer and the pulse sowing machine. It provides smart monitoring, automation, and control, making agriculture more efficient and modern.

Button function

Forward

- Moves the robot forward direction
- Used when you want the machine to go ahead in the field and sow seeds

Reverse

- Moves the robot backward direction
- Useful for correcting position or moving back after reaching the end

Stop

- Stops all movements immediately
- Motors will stop and the robot stays in the same position

Left

- Turns the robot to the left side
- Helps in changing direction or aligning rows

Right

- Turns the robot to the right side
- Used for navigation and row adjustment

Seed on

- Starts the seed spraying/sowing mechanism
- Activates motor or relay connected to seed dispenser
- Seeds begin to drop into soil

Seed off

- Stops the seed spraying mechanism
- Prevents seed wastage when turning or stopping

Overall Working

- Direction buttons (Forward, Reverse, Left, Right) control movement
- Stop ensures safety and control
- Seed ON/OFF controls seed flow

V. TRADITIONAL SEED SOWING TECHNIQUES

Traditional seed sowing methods are the conventional techniques used by farmers to plant seeds in agricultural fields. These methods mainly depend on **human labour and simple tools**. Although they are simple and low cost, they often require more time and effort.

1. Broadcasting Method:

Broadcasting is one of the oldest methods of seed sowing. In this method, seeds are **scattered manually over the field by hand**. Farmers walk across the field and throw seeds in different directions.

This method is very simple and fast, but it has some disadvantages. Seeds may not fall at equal distances, which leads to **uneven plant growth and wastage of seeds**.

2. Dibbling Method:

In the dibbling method, seeds are **placed manually in small holes made in the soil**. Farmers use tools such as sticks or dibblers to create holes and then place one or two seeds in each hole. This method provides **proper spacing between seeds**, which helps in better plant growth. However, it is **time-consuming and requires more manual labour**.



3. Behind the Plough Method

This is a commonly used traditional technique. In this method, a **plough attached to animals like bullocks** is used to make furrows in the soil. Another person drops seeds into the furrows through a pipe or funnel connected to the plough. This method is better than broadcasting because seeds are placed in the soil. However, it still depends on **animal power and manual control**.

4. Manual Row Sowing

In this method, farmers **create rows in the soil using simple hand tools** and place seeds along the rows. After placing the seeds, the soil is covered manually.

This technique helps maintain better spacing and seed placement, but it takes more time and effort.

Factors Affecting Traditional Seed Sowing:

1. Soil Condition – Poor soil quality affects seed germination and plant growth.
2. Seed Quality – Low-quality seeds reduce the germination rate.
3. Seed Spacing – Uneven spacing leads to poor crop development.
4. Depth of Sowing – Incorrect depth affects proper seed germination.
5. Soil Moisture – Lack of water prevents seeds from germinating properly.
6. Climatic Conditions – Temperature and rainfall influence crop growth.
7. Human Error – Manual sowing can cause uneven seed distribution.

VI. AUTOMATED SEED SOWING TECHNIQUES

An Automated Seed Sowing Machine is a device used in agriculture to plant seeds automatically in the soil with proper spacing and depth without much human effort.

It uses components such as a motor, seed container (hopper), sensors, microcontroller, and power supply to control the sowing process. The machine releases seeds into the soil at regular intervals while moving across the field.

This type of machine helps reduce manual labour, save time, ensure uniform seed distribution, and improve crop productivity. In modern systems, technologies like IoT and sensors are also used to monitor soil conditions and control the sowing process efficiently.

1. Mechanical Seed Sowing

In basic automation, mechanical devices like seed drills are used for sowing seeds. Seeds are stored in a container called a hopper and are released into the soil through a rotating mechanism as the machine moves forward. This method ensures uniform distribution of seeds and covers them with soil properly. It is more efficient than traditional hand sowing and is commonly used in many farms.

2. Electrical and Electronic Seed Sowing

Advanced seed sowing systems use electrical and electronic components to improve control and accuracy. Devices such as microcontrollers, DC motors, and relays are used to regulate the flow of seeds. The motor controls the release of seeds, while sensors help maintain proper spacing by detecting movement or distance. These systems reduce manual effort and increase precision in seed placement.

3. IoT-Based Seed Sowing System

IoT-based systems are a more advanced form of automation in agriculture. In these systems, sensors collect data such as soil moisture and environmental conditions, and a microcontroller processes this data to control seed sowing. Farmers can monitor and control the system remotely using mobile devices through Bluetooth or Wi-Fi. This makes farming smarter, as decisions can be made based on real-time data.

4. GPS-Based Precision Farming

In large-scale farming, GPS-based seed sowing techniques are used for high accuracy. Machines follow a predefined path using GPS technology, ensuring seeds are planted at exact positions. This avoids overlapping and reduces wastage of seeds and resources. It also helps in efficient use of land and improves crop yield.

5. Robotic Seed Sowing

Robotic seed sowing is an emerging technology where autonomous robots are used to plant seeds. These robots move through the field, analyse soil conditions using sensors, and sow seeds automatically. This method requires very little human intervention and represents the future of agriculture.

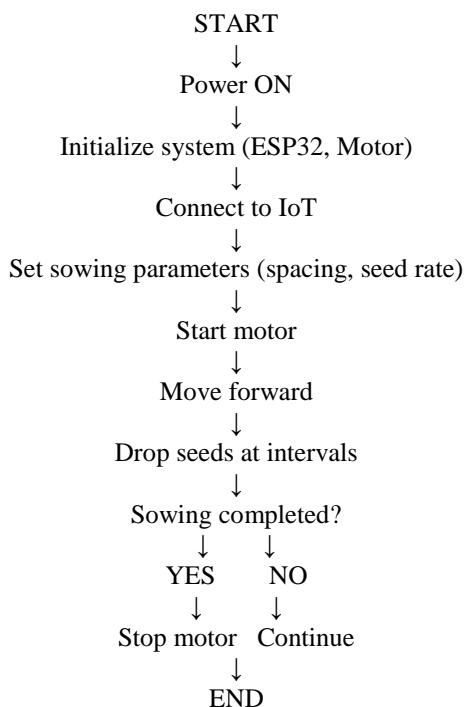
Advantages:

1. Reduces Manual Labor
2. Saves Time



3. Uniform Seed
4. Reduces Seed Wastage
5. Improves Crop Yield
6. Efficient
7. Better Monitoring

VII. FLOWCHART



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